XX. *Experimental Examination of* Platina. *By* William Lewis, *M. B. F. R. S.*

PAPER VI.

Experiments of diſtinguiſhing and purifying Gold mixed with Platina.

1. *By Amalgamation with Mercury.*

Read Mar. 31, 1757.

IN an experiment related in the fourth paper, an amalgam of one part of platina and two of gold with a ſuitable quantity of mercury, having been triturated with water for a conſiderable time, and occaſionally waſhed over, the platina was gradually thrown out, and the gold retained by the quickſilver.

Repetitions of this experiment have ſhewn, that tho' the ſeparation ſucceeds in ſome caſes, it does not perfectly in all: that if there is any particle of the platina imperfectly diſſolved in the gold (which will generally be the caſe, unleſs the quantity of gold is three or four times greater than that of the platina), this part will be retained, after long trituration, undiſſolved by the mercury, uncomminuted by the peſtle, and too ponderous to be waſhed off in its groſs form. A variety of mixtures of platina and gold were treated in the manner above deſcribed; and the gold, recovered from the amalgams, ſubmitted to further examinations. Where the proportion of platina was large, the microſcope almoſt always diſcovered ſtill ſome granules of it on the fracture of the

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the ingot: where the proportion was ſmall, the recovered gold was frequently, but not conſtantly, found to be pure.

From theſe experiments it appears, that mercury has a greater affinity with gold than platina, and that platina is capable of being totally ſeparated by elutriation; but that the proceſs is too vague and undetermined to be applicable in the way of aſſay, as we have no mark of the preciſe time for diſcontinuing it, and as we can never be certain, without making another aſſay, whether the whole of the platina is ſeparated or not. As a preparatory examination, where the quantities of platina and gold to be ſeparated are large, it is nevertheleſs of good uſe, as greateſt part of the platina may by this means be waſhed over with little trouble, and the gold brought into a leſs compaſs, ſo as to be commodiouſly ſubmitted to a perfect purification by the means hereafter pointed out. This proceſs has a ſimilar effect on platina and gold to that of ſtamping and waſhing on metallic ores; which could not be reduced into pure metal in the furnace to advantage, without the previous ſeparation of great part of the earthy and ſtony matter by water.

2. *By Precipitation with Alkalies.*

Gold is precipitated totally by fixed alkaline ſalts, but platina only in part. When ſolutions of the two metals are mixed together, ſo much of the platina remains ſuſpended, after ſaturation with the alkali, as to be readily diſtinguiſhable by the yellow colour, which it communicates to the liquor. It has been objected,

objected, that tho' the platina was diſcoverable, when thus mingled ſuperficially with the gold, it may nevertheleſs, when combined more intimately by fuſion, elude this method of trial.

1. Mixtures of gold with ſmall proportions of platina were therefore kept in fuſion, by a very ſtrong fire, for ſeveral hours, and afterwards diſſolved in aqua-regis. The ſolutions being diluted with water, and a pure fixed alkaline ſalt gradually added, ſo long as any efferveſcence or precipitation enſued, the liquors remained manifeſtly coloured, tho' apparently paler than when the two metals had been diſſolved by themſelves.

2. A more convincing proof, that part of the platina remains ſuſpended, after the precipitation of the gold, was obtained, by putting into the filtered liquors ſome plates of pure tin, which preſently contracted an olive hue, and threw down a large quantity of a browniſh precipitate, as from the common ſolutions of the crude mineral. It was obſervable, that the tin plates were often ſenſibly acted on, even whilſt the liquor was overcharged with alkali.

3. It has been further ſuggeſted, and with great appearance of probability, that as a part of platina is precipitated as well as gold by alkaline ſalts, if only this part be mixed with gold, it will be thrown down by them again upon diſſolving the compound. To determine this point, a precipitate of platina made by fixed alkali was melted with thrice its weight of fine gold, and kept in ſtrong fuſion for above an hour: they united more eaſily than gold does with ſo large a proportion of the crude mineral, and formed a ſmooth neat bead, which hammered well

into a pretty thin plate before it cracked, and appeared internally uniform and equal. This compound being diſſolved in aqua regia, and a fixed alkaline ſalt added by degrees till the acid was more than ſaturated, the liquor became indeed pale; but tin plates put into it quickly diſcovered, that it held a very conſiderable quantity of platina. It appears therefore a conſtant property of this mineral to remain partially diſſolved in the neutraliſed liquor; and that minute proportions of it, mixed with gold, are by this means diſtinguiſhable.

4. Many other experiments were made of the precipitations and precipitates of gold and platina, by alkalies both of the fixed and volatile kind. The moſt remarkable effects were, that volatile alkalies, added to both ſolutions in quantity juſt ſufficient to ſaturate the acid, precipitated gold intirely, but platina only in part, ſo much of it remaining ſuſpended as to give the ſame colour to the liquor as when fixed alkalies were made uſe of: that, on adding a larger quantity of the ſpirit after the precipitation of the gold, the liquor became yellow, a part of the metal being taken up again; and that the platina was more copiouſly rediſſolved, the liquor becoming of a deep browniſh red: that the waſhed precipitates of both metals, whether made by volatile or fixed alkalies, proved ſoluble, by moderate digeſtion, in ſpirit of ſalt; thoſe of platina much more difficultly and ſparingly than thoſe of gold.

3. *By inflammable Liquors.*

1. Inflammable ſpirits, which revive gold from its ſolutions in form of yellow films, have no ſuch effect

on ſolutions of platina. This experiment affords not only a criterion for diſtinguiſhing with certainty whether gold has been debaſed by platina, but likewiſe an infallible means of recovering it perfectly pure from any admixture of that mineral. If the compound be diſſolved in aqua-regis, the ſolution mingled with twice its quantity or more of the ſpirit, and the mixture ſuffered to ſtand for ſome days in a glaſs ſlightly covered; the whole of the gold ariſes to the ſurface, leaving the whole of the platina diſſolved. The golden pellicles may be collected, by pouring the matter into a filter juſt large enough to contain it. The diſſolved platina paſſes thro', leaving the gold upon the paper, which is to be waſhed with freſh parcels of water till the liquor runs colourleſs. The paper is then to be carefully ſqueezed together, and burnt in a crucible previouſly lined with vitrefied borax: when fully ſunk down, a little freſh borax is to be injected, and the fire raiſed to melt the gold. The uſe of lining the crucible with borax is to prevent any moleculæ of the gold from lodging in its cavities.—This proceſs is attended with one inconvenience, the ſlowneſs of the ſeparation of the gold from the ſolution: this may be in ſome meaſure expedited by employing a ſpirit, which has been diſtilled from vegetables, that give over an eſſential oil.

2. As eſſential oils take up gold from aqua-regis, and keep it diſſolved for a time upon the ſurface of the acid; a pure colourleſs oil, that of roſemary, was poured into about half its quantity of a ſolution of platina, the mixture well ſhaken, and ſuffered to reſt: the oil quickly aroſe, without taking up any thing from the platina, or receiving any colour: the acid liquor

liquor underneath remained coloured as at firſt. Compoſitions of platina and gold being diſſolved in aqua-regis, and treated in the ſame manner, the whole of the gold was imbibed by the oil, and the whole of the platina remained diſſolved in the acid. The oil, loaded with the gold, appeared of a fine yellow colour, and, on ſtanding for a few hours, threw off great part of its contents, in bright yellow films, to the ſides of the glaſs. Sundry other diſtilled oils were made trial of, with the ſame event. The gold is eaſily recovered, by ſetting the oil on fire; and, when thoroughly burnt out, melting the reſiduum with borax, as in the preceding experiment. After the ſeparation of the oil employed at firſt, it may be proper, for the greater ſecurity, to add a little more; which, if any part of the gold ſhould happen to have been left in the liquor, will effectually take it up.

3. The experiment was repeated likewiſe with the ſubtile fluid, prepared from vinous ſpirits with the vitriolic acid, called by the chemiſts æther. The ſeparation ſucceeded in the ſame manner as before; the æther receiving nothing from pure platina, but inſtantly taking up the gold from a mixture of the two. It is obſervable, that the gold imbibed by this fluid is kept permanently diſſolved by it; without ſeparating or reviving, as it does from the common eſſential oils and vinous ſpirits.

4. The liquors remaining in theſe experiments, after the extraction of the gold, appear on all trials the ſame with the common ſolutions of platina; and readily betray their being impregnated with that mineral by their colour, by the precipitation with

tin, by their yielding a ſparkling red precipitate with volatile ſpirits, *&c.* A far more minute proportion of platina, mixed with gold, is more diſtinguiſhable by theſe proceſſes, than by thoſe with alkaline ſalts above-mentioned; theſe exhibiting the whole of the platina diſſolved by itſelf, thoſe only a part of it.

4. *By metallic Solutions.*

All the metals, which precipitate gold from aqua-regia, have been already ſhewn to precipitate platina alſo. As gold is thrown down by ſome metallic ſolutions, as well as by the metals in ſubſtance, particularly thoſe of mercury and iron, it remains to apply theſe liquors as precipitants for platina.

1. A ſaturated ſolution of mercury in aqua-fortis, which readily and totally threw down gold in its metallic form, being added to a ſolution of platina, the liquor became immediately turbid, and, on ſtanding for a little time, nearly the whole of the platina fell to the bottom. A ſolution of mercury in the marine acid, or of corroſive ſublimate, likewiſe precipitated platina, but leſs perfectly, and with this difference, that the former precipitate was of a greyiſh brown colour, the latter of a ſparkling red.

2. Solutions of iron in the vitriolic acid, or of common green vitriol in water, which totally threw down gold, happily made no change in ſolutions of platina. Compoſitions of platina and gold being diſſolved in aqua-regis, the ſolutions diluted with about twice their quantity of water, and a filtered ſolution of the vitriol gradually added; the mixtures inſtantly grew turbid, and, on ſtanding, depoſited the gold in form

form of a purpliſh grey calx, the whole of the platina remaining diſſolved. It appeared, on numerous repetitions of this experiment, that no part of the platina was precipitated along with the gold, nor any of the gold kept ſuſpended with the platina. Where the quantity of the mixt to be aſſayed was very ſmall, the precipitation was uſually performed in a filter, that the gold, which ſeparates in very minute moleculæ, ſome of which might poſſibly remain unobſerved in the bottom of a glaſs, might be detained on the paper. The colourleſs ſorts of filtering-paper are preferable for this uſe to the coloured; as theſe laſt may be impregnated with aſtringent matter, which would extricate ſome of the ferrugineous part of the vitriol. The vitriol was diſſolved in about ſix times its quantity of water, and a few drops of oil of vitriol added, to prevent the ſeparation of any of its iron in the filter. This ſolution was put into the filter firſt, the ſolution of gold and platina immediately poured into it, the whole ſtirred together with a clean glaſs rod, and ſuch part of the liquor, as had run thro' before they had been duly mixed, poured back to the reſt. The gold remaining in the filter was waſhed with freſh parcels of water, the paper cautiouſly rolled up, and burnt in a crucible, as mentioned in a former experiment.

3. Solutions of the vitriol, recommended by Kunckel and others for precipitating gold of an uncommonly high colour, made no change in the ſolutions either of gold or platina. The bluiſh green did indeed precipitate the gold; not as blue vitriols, but by virtue of the ferrugineous matter, of which theſe kinds largely participate. White vitriol was likewiſe

made trial of, but without producing any ſenſible effect in either ſolution.

4. The experiments with green vitriol were repeated on the ſolutions of platina and gold made in ſpirit of ſalt. The event was the ſame as with thoſe made in aqua-regis; the gold being conſtantly precipitated, and the platina remaining diſſolved.

REMARKS.

It may be proper to obſerve, that by the proceſſes here pointed out, the gold is purified from other metallic admixtures at the ſame time that it is ſeparated from platina; the inflammable ſpirits reviving, eſſential oils and æther imbibing, and green vitriol precipitating, gold alone. Care ſhould be had, that the piece of the mixt, taken for examination, be totally diſſolved before any trials are made with the ſolution; the menſtruum not acting with equal facility on the two metals, but diſſolving the gold more readily than the platina. Where the acid has been dilute, and only a gentle heat applied, great part of the gold has appeared to be taken up before the platina was conſiderably acted on. Where the filter, with the gold in it, is burnt in the crucible, borax is the moſt commodious flux: but as this ſalt gives a ſenſible paleneſs to gold, a little nitre may be injected, after the metal has come into fuſion, to reſtore its colour. If the nitre was added at firſt, whilſt the gold continues ſubtilely divided, ſome particles of the metal would be diſſipated during the deflagration, which that ſalt produces with the coaly remains of the paper.

As the foregoing experiments exhibit platina and gold diſſolved in a mineral fluid, which by ſimple mechanic agitation rejects the one and retains the other, and which diſcovers this different appetite of union ſo much the more remarkably, as the two metals have been the more intimately combined:— as they further exhibit platina diſſolved in liquors incapable of holding gold ſuſpended,—gold diſſolved in liquors incapable of holding platina ſuſpended,--- gold totally precipitated by ſubſtances, which precipitate no particle of platina,--- and gold, when mixed *per minima* with platina, perfectly recovered from it by theſe means, without increaſe as well as without diminution: --- it follows, that platina is not, as ſome believe, gold naturally debaſed by the admixture of ſome other metallic body, but a metal of a peculiar kind, eſſentially different from all the others. Before the diſcriminating characters of platina were diſcovered, ſuch a notion was highly plauſible, and direct experiment ſeemed to confirm it: a portion of the platina might be ſeparated in the proceſs; a quantity of gold mixed with the remainder, in order to collect the gold ſuppoſed to be contained in it; the mixture ſubmitted to operations, which gold alone was ſuppoſed capable of withſtanding; and the augmentation, which the noble metal ſtill retained, held to be true gold gained from the platina.

The methods of trial above related will, it is preſumed, be ſufficient to undeceive thoſe, who may have been impoſed upon by ſuch appearances, and betrayed into the practice of unintended frauds: to convince them, that all they have gained from platina, after the moſt laborious attempts to diveſt it of its imaginary coat, is no other than platina ſtill: and, which is of more extenſive utility, to diſtinguiſh all the abuſes, that may be made with this metal, and reſtore the gold, ſo debaſed, to its original purity and value.

XXI. *An Account of the Temple of* Serapis *at* Pozzuoli *in the Kingdom of* Naples: *In a Letter to* John Ward, *LL.D. and R.S. Vice-Præſ. by the Rev.* John Nixon, *M.A. F.R.S.*

SIR,

Read Mar. 17. 1757. BEFORE we enter upon a more particular conſideration of this noble piece of antiquity, it may not be improper to premiſe the general account (and indeed the only one I have met with yet publiſhed), which is given of it by Meſſ. Cochin and Bellicard, in a little (1) treatiſe printed at Paris in 1755. Theſe gentlemen acquaint us, that in 1749 there were only three pillars of this building viſible, and that they were buried half way within the ground: but that ſoon after, workmen being employed by order of the King of the Two Sicilies to dig at the place, they came to the pedeſtals of thoſe pillars; and at length diſcovered the building to have been a temple, which

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(1) Obſervations ſur les Antiquités d'Herculaneum, *&c.* p. 82.

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